

detected in every cell of the green tissue, especially in *Pinus maritima*.

From the facts here communicated I believe that I have, in the first place, established anatomically and microchemically the individuality of the hypochlorin in the chlorophyll-bodies, and proved the necessity of light for its formation in the Angiosperms. With regard to the physiological relations of chlorophyll to hypochlorin I have already given some intimations, and expressed the opinion that chlorophyll, by means of its absorption of light, protects the hypochlorin from combustion in intense light. Upon the presumable genetic relations of chlorophyll to hypochlorin my investigations are not yet completed.

XXXII.—*On a Collection of Lepidoptera from Madagascar, with Descriptions of new Genera and Species.* By ARTHUR G. BUTLER, F.L.S., F.Z.S., &c.

THE following species have been selected from a large collection made at Fianarantsoa by the Rev. W. Deans Cowan.

RHOPALOCERA.

Nymphalidæ.

SATYRINÆ.

1. *Gnophodes betsimena* ♀.

Cyllo betsimena, Boisduval, Faune Mad. p. 58. n. 1 (1833).

A fine specimen.

In my Catalogue of Fabrician Lepidoptera I erroneously sunk this species as a synonym of *G. pythia*; now that we possess both I find the Madagascar species much nearer to the *G. parmeno* of Trimen from Natal, which is of the same size and form, but instead of a broad oblique white belt on the primaries has a rather narrow angulated ochreous one. As the *G. parmeno* of Trimen is not identical with the West-African form, I propose to call it *G. diversa*.

2. *Pseudonympha subsimilis*.

Pseudonympha subsimilis, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 228. n. 3 (1879).

The type was also taken at Fianarantsoa.

3. *Pseudonympha Cowani*, sp. n.

Allied to the preceding, but considerably larger; above with a white subapical spot replacing the ordinary subapical ocellus, and the secondaries with two ocelli as in *P. ankova*; the large ocellus of primaries and the dark submarginal lines as in the allied species. Under surface of primaries similar to *P. ankova*, but with the outer border creamy white, with dark brown submarginal and marginal lines, a cream-coloured subapical patch followed by two or three snow-white dots: secondaries cream-coloured, the central belt broadly zigzag; both it, the basal, and abdominal areas mottled with brown; three large ocelli, one at costa near apex, the others on the median interspaces; two slightly undulated submarginal lines and the fringe brown. Expanse of wings 1 inch 8-9 lines.

4. *Pseudonympha ankova*.

Mycalesis ankova, Ward, Ent. Month. Mag. vii. p. 31 (1870); Afr. Lep. p. 15, pl. 12. figs. 3, 4 (1874).

5. *Pseudonympha ibitina*.

Mycalesis ibitina, Ward, Ent. Month. Mag. x. p. 60 (1873).

A slight variety with unusually distinct markings on the under surface.

6. *Pseudonympha turbata*, sp. n.

Wings above fuliginous brown: primaries with two large white-pupilled and red-zoned black ocelli upon the disk, the lower one twice the size of the upper; fringe grey: secondaries with three ocelli, two of medium size on the median interspaces, and the third very small upon the radial interspaces; a feebly indicated submarginal dusky line; fringe grey. Wings below olivaceous brown, indistinctly mottled with darker lines: primaries with four abbreviated ferruginous streaks across the discoidal cell, the second of these streaks extending slightly below the cell; a ferruginous angulated stripe beyond the cell, its lower portion broadly arched, so as to bound the inner edge of the large inferior ocellus; the latter also has a ferruginous external border; the subapical ocellus extremely small, with scarcely a trace of the red zone of the upper surface; a subapical dusky patch upon the outer margin: secondaries with the disk slightly lilacine; the margins of the ordinary belt irregularly angulated somewhat as in *P. ankova*, the external border dark brown at apex; a discal series of six minute spots, the first punctiform and black, the three following punctiform but white, the last two

slightly larger, black with white pupils. Expanse of wings 1 inch 7 lines.

CALLYPHTHIMA, gen. nov.

Allied to *Pseudonympha* and *Ypthima*, but the male with more prolonged subangulated primaries, the female with broader and consequently less evidently subangulated primaries than in the male: the secondaries distinctly longer than in the above-mentioned genera, with a distinct abdominal angle forming a feebly pronounced anal lobe; palpi larger and much more hairy. Type *C. Wardii*.

7. *Callyphthima Wardii*.

♀. *Pseudonympha Wardii*, Butler, Cist. Ent. ii. p. 390 (1879).

♂. Smaller than the female, and altogether darker on both surfaces. Expanse of wings 1 inch 6 lines.

This species appears to be not uncommon.

8. *Ypthima rakoto*.

Erebia rakoto, Ward, Ent. Month. Mag. vii. p. 30 (1870).

This species is extremely close to *Y. Vinsonii*, but smaller and with the disk of primaries below less distinctly greyish white; the ocelli on the under surface of secondaries are placed one on the first median interspace and the other on the superior subcostal interspace in both of our examples.

9. *Ypthima Batesii*.

Ypthima Batesii, Felder, Reise der Nov. Lep. iii. tab. 68. figs. 10, 11 (1867).

A female example, thus placing the distinctness of *Y. niveata* beyond a doubt.

10. *Mycalesis perdita*.

Mycalesis perdita, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 283. n. 2 (1878).

11. *Mycalesis bicristata*?

Mycalesis bicristata, Mabille, Bull. Soc. Zool. France, vol. iii. p. 81 (1878).

I have to thank Mr. Moore for lending me a copy of the memoir in which this species is described.

NYMPHALINÆ.

12. *Charaxes cinadon*.

Charaxes cinadon, Hewitson, Ent. Month. Mag. vi. p. 177 (1870).

A pair of this fine species, somewhat damaged.

This species was originally described from a Natal male example in Mr. Ward's collection; it was subsequently sunk as a synonym of my *C. Druceanus* from the West Coast; it is intermediate in character between the latter species and *C. phraortes*, being the size of the latter.

13. *Charaxes Cowani*.

♂. *Charaxes Cowani*, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 285. n. 6 (1878).

♀. Similar in pattern to the male, but with the ground-colour of the basal area above ochraceous. Expanse of wings 3 inches 10 lines.

The male seems to be not uncommon.

14. *Panopea apaturoides*.

Panopea apaturoides, Felder, Reise der Nov. Lep. iii. p. 416. n. 643 (1867).

Pseudacraea drusilla, Saalmüller, Bericht über die Senckenbergische naturforschende Gesellschaft, 1878, p. 81. n. 25.

This species varies somewhat in size and in the distinctness of the submarginal white dots on the upper surface of the wings.

15. *Panopea diffusa*, sp. n.

Allied to *P. dubia* and *P. Bewsheri*, nearest to the former, but differing as follows:—Primaries with the oblique sub-apical series of spots forming a single trifid band, which externally is diffused and lilacine greyish, almost as in *P. anthedon*; the large white patch across the median interspaces continued downwards in the form of a diffused greyish nebula to the submedian vein; the abdominal area of secondaries dark brown (as in *P. Bewsheri* and *P. Drucei*) instead of broadly testaceous; five prominent rounded submarginal white spots on these wings. Expanse of wings 3 inches.

16. *Hypanartia hippomenes*.

Hypanartia hippomenes, Hübner, Samml. exot. Schmett. (1816–24).

This species occurs also in Natal, as does the *H. hippomenes* of Boisduval. The latter is a perfectly distinct species, much larger, longer in wing and tail, with duller coloration on the under surface and very different pattern for this species I propose the name of *H. commixta*.

Lycænidæ.

LYCÆNINÆ.

17. *Castalius auratus*, sp. n.

Golden cupreous above, with the veins, internervular folds,

two blue-centred anal spots in the secondaries, and the body above black; wings below snow-white, with brown-edged markings similar in form and position to those in *C. Poggei* (Dewitz in Nova Acta Acad. Leop.-Carol. Nat. Scr. p. 33, pl. xxvi. fig. 7), but not filled in with black as in that species. Expanse of wings 1 inch 1 line.

This species may be readily distinguished from the West-African *C. Poggei* by the metallic golden coloration of the upper surface, and the slenderness and length of the inter-nervular black streaks, in which last character it agrees with *C. juba* ♂, Fabr. (*Plebeius Falkensteinii*, Dewitz), figured in my Fabrician Catalogue, pl. ii. fig. 9.

18. *Castalius leucon*.

Lycæna leucon, Mabille in litt.

This species having only at present appeared in an advertisement-sheet (Pet. Nouv. ii. p. 289, 1879), I cannot regard it as a published species; it may, however, be the female of my *Castalius azureus*, from which it differs on the under surface in the absence of the discal series of black spots on the primaries.

Papilionidæ.

PIERINÆ.

19. *Nychitona sylvicola*.

Leucophasia sylvicola, Boisduval, Faun. Madag. p. 20 (1833).

The black apical patch is strongly marked in this example precisely as in our *N. medusa*.

The pure white species is apparently referable to *N. nupta*.

20. *Terias aliena*, sp. n.

Above bright sulphur-yellow, paler upon external border; primaries with a pale brown regular apical border: secondaries subangulated. Wings below uniform sulphur-yellow: primaries with a squamose dark brown dot in the cell; two dots on the discocellulars, a large quadrate apical patch, and the greater part of the outer margin pale orange: secondaries with two widely separated dots near the base, two lunate markings below the first and second median branches, and two small annular markings on the discocellulars brown; a subcostal dash, a broad oblique subapical streak, and a lunate marking on the second median interspace orange; veins terminating in extremely minute black points; fringe saffron-yellow. Expanse of wings 1 inch 5 lines.

Unfortunately only one example of this singular *Terias* has been received.

21. *Catopsilia decipiens*, sp. n.

♂. Above white, tinted with sulphur-yellow, which becomes more intense towards the middle of the wing; primaries with the costal border and basal third bright gamboge-yellow, outer edge of the basal area trisinate and oblique; secondaries with the basal half, excepting on abdominal border, bright gamboge-yellow; the usual pinky-white sub-costal elongated mealy patch: head pale greyish flesh-colour; collar of the same colour in front, but greenish behind; thorax and base of abdomen greenish sulphur, remainder of abdomen white; antennæ above grey, with orange-tipped blackish club, below pale buff. Primaries below with the lower half of the cell and interno-median area bright sulphur-yellow, diffused externally; the usual thick sulphur-yellow scent-fan on internal border; disk white; costal, apical, and external areas cream-coloured: secondaries and pectus cream-coloured, venter white. Expanse of wings 2 inches 8–11 lines.

♀. Wings above white: primaries with the basal two fifths bright sulphur-yellow; a large black spot at the end of the cell; costal border testaceous at base, otherwise dark brown; apical and external borders rather narrowly dark brown, the latter broken up into spots towards the external angle; an angulated series of four widely separated but nearly equidistant dark brown spots across the disk: secondaries with the lower part of the cell and interno-median area tinted with sulphur-yellow; an indistinct irregular discal series of spots, and a still less distinct marginal series brown: head and collar pale purplish brown; tegulæ the same colour at the base, but tipped and fringed with whitish; thorax blackish, clothed with greenish-white hairs; abdomen white. Primaries below with an orange streak at the base of the cell, and a greyish annulus on the discocellulars, otherwise as in the male; secondaries and body as in the male. Expanse of wings 2 inches 8 lines.

Of this interesting species Mr. Cowan sent two males and one female; it takes the place of *C. crocale* in Madagascar, just as *C. thauruma* does that of *C. catilla*.

22. *Belenois coniata*.

Belenois coniata, Butler, Cist. Ent. ii. p. 391 (1879).

The present example measures only 2 inches 1 line in expanse of wing. The species seems not to be uncommon.

Hesperiidæ.

23. *Hesperia ratek*.

Thymele ratek, Boisduval, Faun. Madag. p. 61, pl. ix. fig. 1 (1833).

The figure of this species is barely recognizable; but, fortunately, the description enables one to determine it satisfactorily.

24. *Hesperia fervida*, sp. n.

Primaries above fuliginous brown: secondaries deep orange, with the costal border, the external border to just beyond the first median branch, and a triangular spot at the extremity of the submedian vein fuliginous brown; abdominal border yellowish; fringe black at anal angle and at extremity of submedian and first median branch: head above green, spotted with white; palpi black and white; thorax testaceous, sprinkled with dark green hairs; abdomen brown, banded with ochraceous. Primaries below brown: secondaries silvery white, with the abdominal area broadly brown; anal angle ochreous, external border to submedian vein rather broadly brown: head below white: body brown, clothed with ochreous hairs; legs ferruginous; anterior coxæ orange, anterior tibiæ with a white stripe above. Expanse of wings 2 inches.

One example.

Nearest to *H. pisistratus* from West Africa.

25. *Cyclopides pardalina*.

Cyclopides pardalina, Butler, Ann. & Mag. Nat. Hist. ser. 5. vol. iv. p. 233. n. 15 (1879).

HETEROCERA.

Sphingidæ.

26. *Hemaris apus*.

Macroglossa apus, Boisduval, Faun. Madag. p. 79, pl. x. fig. 4 (1833).

Dr. Boisduval's figure is by no means characteristic.

27. *Nephele malgassica*.

Zonilia malgassica, Felder, Reise der Nov. Lep. iv. tab. lxxvi. fig. 2.

Felder's representation of this species is altogether too green.

Agaristidæ.

28. *Eusemia metagrius*, sp. n. (no. 58).

Above deep chocolate-brown: primaries crossed just beyond the middle by a pale yellow band, as in *E. agrius*; base of

costal border black, with two yellow dots and a metallic plumbaginous spot: secondaries with a broad, irregular, pale yellow patch from the origin of the subcostal branches to the submedian vein; basal area of a rather paler brown than the external area; head and collar black, spotted with yellow; abdomen black, banded with dull orange. Primaries below with the base bright ochreous, otherwise as above: secondaries with the basi-abdominal area occupied by a broad subquadrate pale yellow patch, washed at base with ochreous; three submarginal white dots: body below dull ochraceous. Expanse of wings 2 inches 2 lines.

In coloration this species is not unlike *Rothia Westwoodii* (*Eusemia virguncula*?, Mab.); but the form is quite different.

29. *Eusemia tranquilla*, sp. n.

Allied to the preceding species, but darker, the belt of primaries of double the width and less oblique: secondaries with the base purplish black; a broad patch of pale green sprinkled along its inner margin, with orange scales which form a distinct spot upon it just within the extremity of the discoidal cell: the body less distinctly banded. Primaries below with the band even wider than above, the base bright orange: secondaries bright orange, with the outer two thirds of costal border, the apex, and external border deep brown. Body ochreous, venter banded with black. Expanse of wings 2 inches 1 line.

This is of the same form as *E. metagrius*.

(Zygæmoid) **Arctiidae**.

MYDRODOXA, gen. nov.

Body and legs very robust, wings broad. Primaries with straight costal and convex inner margin, outer margin slightly convex; costal vein extending to second third of costa; subcostal six-branched, first branch emitted before the end of the cell, united by a cross spur with the second, which is emitted from the end of the cell, and from below which the remaining four are thrown off; the sixth branch is in reality the upper radial; upper discocellular strongly angulated, lower extremely short, so that the lower radial almost looks like a fourth median branch. Secondaries subtriangular; neuration normal—that is, the costal vein extending to apex, the subcostal two-branched (although the branches are emitted from a short footstalk), discocellular angulated, median three-branched, submedian and internal veins as usual. Type *M. splendens*.

30. *Mydrodora splendens*, sp. n.

Primaries above with the basal two thirds fiery cupreous, gradually shading off into golden green at the margins and crossed by a broad, velvety, greenish-black belt; external third dark shining blue-green; base of inner margin shining dark green: secondaries shining steel-blue, greenish in certain lights, with the base and costal border blackish: frons, collar, pro-, and mesothorax velvety black; three basal segments of abdomen and body below steel-blue, varying to dark green; vertex of head, metathorax, the four posterior segments of abdomen, and anal tuft carmine-red. Wings below golden green, changing to blue-green towards the internal borders; internal border of primaries purple. Expanse of wings 1 inch 9 lines.

This magnificent moth reminds one, in the size, form, and coloration of its wings, of the New-World genus *Eupyra*; in its shorter head and shorter and more slender palpi, and in its neururation, it approaches more nearly to the typical *Arctiidæ*.

(Typical) *Arctiidæ*.31. *Daphænura fasciata*.

Daphænura fasciata, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 457 (1878).

The specimen now received exhibits a structural character not visible in the typical examples, but first pointed out to me by Mr. Druce in specimens in his collection: the male possesses an enormously developed pair of scent-fans in the form of broad compressed curved brushes, apparently jointed at the base, and capable of retraction behind the hairy clothing of the posterior coxæ. In my typical male these fans are completely concealed; but in the specimen now obtained they are fully exerted, are of a sandy yellow or testaceous colour, and are 4 lines in length.

EPICAUSIS, gen. nov.

Body broad, long, robust, hairy, with enormous anal tuft; antennæ thick, very feebly pectinated; palpi moderately long, distinctly visible in front of the head. Primaries very long, subtriangular, with straight costal and slightly convex external and inner margins; costal vein extending to fourth fifth of costa; subcostal five-branched, first branch emitted from third fourth of anterior margin of cell, other veins exactly as in *Acronycta* (see Trans. Ent. Soc. 1879, pl. xi. fig. 1). Secondaries short, about half the length of primaries,

with slightly convex costa and outer margin and straight abdominal margin; costal vein extending to apex; discoidal cell extending to the middle of the wing; subcostal with two branches emitted from a long footstalk beyond the cell; discocellular long and angled; lower discocellular short and slightly elbowed; median vein three-branched, the second and third branches emitted from a very short footstalk; submedian and internal veins as usual. Type *Epicausis lanigera*.

32. *Epicausis lanigera*, sp. n.

Wings bright orange, with black external borders: primaries with four transverse black abbreviated dashes upon the basal area; two broader black dashes upon the apical half of costa; two black dashes on basal half of internal border, and two more near the external angle; external border distinctly dentated on its inner margin; secondaries with the basal two fifths black, clothed at the base with ochreous hair; outer border regularly and rather broadly black: head, thorax, and anal tuft carmine; abdomen velvety black. Wings below paler orange than above, with black external border, that of primaries emitting a subapical curved band (at lower radial vein), which runs inwards to the costa; a black spot near the base of costa, and a black patch at base of interno-median area: secondaries with the interno-basal area black: body below black, with the subanal segment broadly fringed with carmine; anus black, anal tuft carmine as above. Expanse of wings 2 inches 5 lines.

Three examples, two of which are in moderately good condition, were sent home.

Lithosiidæ.

ISORROPUS, gen. nov.

Allied to *Dyphlebia*, but with broader wings. Primaries with the costal vein terminating at second third of costa; subcostal five-branched, the first two branches emitted before the end of the cell and united by an oblique spur or veinlet to the third branch, which is emitted from the end of the cell and is trifurcate; only one radial emitted from the end of the cell, at the same point with the third subcostal branch; discocellular angulated; median vein three-branched, the last two branches emitted from a long footstalk. Secondaries with the costal vein reaching to apex; subcostal forking from the costal at basal fourth, emitting its two branches from a long footstalk beyond the end of the cell; cell reaching to the

middle of the wing, discocellular strongly angulated; median vein emitting its second and third branches from a very long footstalk. Body similar to *Dyphlebia*. Type *I. tricolor*.

33. *Isorropus tricolor*, sp. n.

Wings bright orange, with broad black-brown outer borders, widest upon the costal margin; primaries with a broad black-brown central belt, both border and belt on these wings shot with dark green: body carmine-red. Expanse of wings 1 inch 5 lines.

Two examples of this species were sent home; but one of these is so much worn and broken as to be valueless; the type is in fairly good condition.

34. *Sommeria extensa*, sp. n. (no. 15).

Primaries chalky white; five black dots at the base followed by a short dark brown costal dash, two black dots in the cell and two near the base of interno-median area; a zigzag central olive-brown stripe from costa to inner margin, an oblique series of fusiform olive-brown spots from the end of the cell to the costa, and an indistinct irregularly angulated discal series from apex to external angle: secondaries cream-coloured: thorax white, black-spotted; abdomen ochreous, with dorsal and lateral series of black spots; antennæ black. Primaries below paler than above; costal borders testaceous; black dots obsolete, brown markings indistinct: secondaries sordid white, with testaceous costal border and veins; body below white, pectus black-spotted. Expanse of wings 1 inch 10 lines.

One example only; it is most nearly allied to *S. privata*, but is considerably larger, with much longer wings.

HYPSINÆ.

35. *Aganais borbonica*.

Aganais borbonica, Boisduval, Faun. Madag. p. 96, pl. xv. fig. 1 (1833).

I cannot believe that this is the male of the following, the sexes of all the other species being extremely similar, and the supposed female being of the same form and coloration as the species of *Damalis*.

36. *Damalis insularis*.

Aganais insularis, Boisduval, Faun. Madag. p. 97, pl. xv. fig. 2 (1833).

Nearly allied to *D. egens*.

Nyctemeridæ.

37. *Nyctemera biformis* ♂.

Nycthemera (sic) *biformis*, Mabilie, Bull. Soc. Zool. France, vol. iii. p. 88 (1878).

38. *Hylemera fragilis*.

Hylemera fragilis, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. iv. p. 236. n. 24 (1879).

Previously received from Antananarivo.

[To be continued.]

MISCELLANEOUS.

On the Resistance of Aphides to Severe Cold.

By M. J. LICHTENSTEIN.

THE author remarks that he has endeavoured to show that, just as a plant can reproduce itself by seeds and by buds, the vine-*Phylloxera* (*P. vastatrix*) is also able to reproduce both by fecundated eggs and by subterranean budding colonies—the duration of which latter may be as indefinite as that of the plant, given the necessary nourishment and warmth. This last condition seems indispensable for the agamic reproduction, but not for the existence of the insect.

During December last, when temperatures of -11° or -12° C. ($= +12^{\circ}\cdot2$ or $10^{\circ}\cdot4$ F.) prevailed, the author found not only that the underground *Phylloxera* did not suffer at all, but that he could collect upon trees and plants in his garden numerous Aphides (he mentions *Aphis persicæ*, *euonymi*, *hederæ*, *brassicæ*, and *capsellæ*, and *Rhopalosiphon berberidis*), all stupefied by the great cold and often covered with snow or hoar-frost, but perfectly alive. The Aphides were all in the budding phase; but close by them, upon the same plants, there were eggs laid in the autumn by the fecundated females, which had long before disappeared.

The Aphides were carried into a room at a temperature of 8° – 10° C. ($= 46^{\circ}\cdot4$ – 50° F.), and the twigs to which they adhered planted in damp sand. In two or three days they all began to breed, bringing forth living young. Suspended by the cold, the faculty of gemmation was by no means extinct.

As there are perennial and annual plants, so among the Aphides there are species which die out every year, except the eggs, and others with indefinite reproduction by gemmation. All the above species are perennial; and it is curious that while warmth immediately causes the false females, or budding pseudogynes, to recommence their gemmation, the true egg does not hatch, and seems to await the shooting of the plants upon which it is fixed.

M. Lichtenstein believes that the annual species are much more numerous than those of unlimited duration. Thus the *Phylloxera* of the oak (*P. quercus*, *coccinea*, and *corticalis*), the Aphides of the